

PATENT COOPERATION TREATY

PCT

NOTIFICATION OF ELECTION

(PCT Rule 61.2)

From the INTERNATIONAL BUREAU

To:

Assistant Commissioner for Patents
United States Patent and Trademark
Office
Box PCT
Washington, D.C.20231
ETATS-UNIS D'AMERIQUE

in its capacity as elected Office

Date of mailing (day/month/year) 11 September 2000 (11.09.00)	
International application No. PCT/GB00/00022	Applicant's or agent's file reference C522.01/W
International filing date (day/month/year) 07 January 2000 (07.01.00)	Priority date (day/month/year) 03 February 1999 (03.02.99)
Applicant LAYCOCK, Michael	

1. The designated Office is hereby notified of its election made:



in the demand filed with the International Preliminary Examining Authority on:

08 August 2000 (08.08.00)



in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was

was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.: (41-22) 740.14.35	Authorized officer Olivia TEFY Telephone No.: (41-22) 338.83.38
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PATENT COOPERATION TREATY

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REC'D 11 MAY 2001

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

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Applicant's or agent's file reference KWN/DB/C522.01/W		FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/GB00/00022	International filing date (day/month/year) 07/01/2000	Priority date (day/month/year) 03/02/1999
International Patent Classification (IPC) or national classification and IPC B24B5/01		
Applicant UNOVA U.K. LIMITED et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 6 sheets, including this cover sheet.
- ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 6 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☒ Certain defects in the international application
- VIII ☒ Certain observations on the international application

Date of submission of the demand 08/08/2000	Date of completion of this report 09.05.2001
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Gelder, K Telephone No. +49 89 2399 2421



INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/00022

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):
- Description, pages:**

1-11 as originally filed

Claims, No.:

1-12 as received on 29/03/2001 with letter of 26/03/2001

Drawings, sheets:

1/2,2/2 as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/GB00/00022

☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims
	No:	Claims 1-12
Inventive step (IS)	Yes:	Claims
	No:	Claims 1-12
Industrial applicability (IA)	Yes:	Claims 1-12
	No:	Claims

2. Citations and explanations
see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

Re Item VIII

Certain observations on the international application

- (i) The number and arrangement of independent claims is such as to create obscurity in the definition of the subject-matter to be protected. The claims therefore lack clarity and conciseness, contrary to Article 6 PCT.
- (ii) The term "conventional cylindrical grinding wheel" used in claims 1 to 8 is vague and does not impose any limitation as to the structure of the grinding wheel. The claims lack clarity also for this reason, contrary to Article 6 PCT.
- (iii) In claim 9, the feature that one of the faces is parallel to the wheel axis and has at the same time a frusto-conical surface is unclear, since a grinding face parallel to the wheel axis would mean that it has a cylindrical rather than a frusto-conical surface (Article 6 PCT). Likewise, the cross-reference in claim 9 "for use in the apparatus according to any one of claims 1, 2, 5 or 6, or in the method of any one of claims 3, 4 or 7" causes a lack of clarity, since the feature that the grinding wheel comprises first and second frusto-conical surfaces is contradictory to the cylindrical grinding wheel specified in claims 1 to 7.
- (iii) Although some of the claims are drafted as apparatus claims, they contain features of their use or method steps, see for example claim 1, last four lines, claim 5, "machine when programmed", claim 9, from line 9 onwards. It should be noted that such features do not impose any limitations to the apparatus as such, except that the apparatus is suitable for such use.

Re Item V

Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

- (i) Reference is made to the following documents:
 - D1: '7-ACHSEN-SCHLEIFZENTRUM FUER SIMULTANES INNEN- UND AUSSENSCHLEIFEN' VDI Z, DE, VDI VERLAG GMBH. DUSSELDORF, vol. 132, no. 7, 1 July 1990 (1990-07-01), page 92 XP000136011 ISSN: 0042-1766
 - D2: DE 15 77 485 A (SCHAUDT MASCHINENBAU GMBH) 16 September 1971

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB00/00022

(1971-09-16)

- D3: US-A-4 709 509 (YONEDA TAKAO ET AL) 1 December 1987 (1987-12-01)
- D4: EP-A-0 169 971 (BARBISAN LUCIANO) 5 February 1986 (1986-02-05)
- D5: EP-A-0 257 194 (BUDERUS KUNDENGUSS) 2 March 1988 (1988-03-02)
- D6: G. Spur, Th. Stöferle, Handbuch der Fertigungstechnik, Band 3/2 Spanen, Carl Hanser Verlag, München, Wien 1980, p. 114, figure 9
- D7: Manfred Weck, Werkzeugmaschinen Fertigungssysteme, Band 1, VDI Verlag 1991, p. 215ff., chapter 3.1.5.1.1
- D8: US-A-3 636 664
- D9: US-A-4 603 514
- D10: FR-A-2 519 282

(ii) Claim 9

The claim defines a grinding wheel as such. A grinding wheel comprising first and second frusto-conical surfaces, the first frusto-conical grinding face being perpendicular to the second frusto-conical grinding face, is generally known, see documents D1 (figure 2, external grinding wheel; figure 3, mid drawing, internal grinding wheel) to D7. It goes without saying that this known wheel is suitable to be used in the manner defined in claim 9, from line 9 onwards.

Consequently, the subject-matter of claim 9 is not new in the sense of Article 33(2) PCT.

(iii) Claims 10 to 12

CNC grinding machines having a frusto-conical grinding wheel and programmed as defined in claim 10 have been generally known in the art, see, for example, D1, D3 or D4..

Cooling and dressing has been widely used in such grinding apparatus and methods, see D4, page 7, last paragraph and the paragraph bridging pages 4 and 5 and claims.

Therefore, the subject-matter of claims 10 and 12, respectively, lacks also novelty in the sense of Article 33(2) PCT.

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB00/00022

(iv) Claims 1 to 8

CNC grinding machines having a cylindrical grinding wheel allowing simultaneous single plunge grind of an external or internal annular shoulder at an end of the external or internal cylindrical surface and the cylindrical surface adjoining the shoulder, irrespective of whether the relative movement between the grinding wheel and the workpiece is generated by the wheelhead only (claims 1 to 5) or by the wheelhead and a workpiece carriage (claims 6 to 8), are generally known in the art, see documents D8, Figure 1, col. 1, lines 54 to 57, claim 5, D9, Figure 4, claim 1, features (b) and (c), or D10, Figure 2.

Therefore, the subject-matter of claims 1 to 8, respectively, lacks novelty in the sense of Article 33(2) PCT.

Re Item VII

Certain defects in the international application

The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

C522.01/W

Claims

1. A grinding machine having a conventional cylindrical grinding wheel mounted on the machine wheelhead for movement parallel to the X and Z-axes of the machine (where the Z-axis is the axis of rotation of the workpiece and the X-axis is perpendicular thereto), wherein the wheel is mounted for rotation about an axis which remains parallel to the workpiece axis of rotation, X and Z-axis drive means are provided for moving the wheelhead relative to the workpiece parallel to the X and Z axes respectively, and control signals for determining the advance along the X and Z-axes are derived from a programmed computer which causes the wheelhead to advance towards and into engagement with a cylindrical surface of the workpiece along a line of action which subtends an angle of less than 90° to the Z-axis, the angle of approach being such as to simultaneously plunge grind an annular shoulder at an end of the cylindrical surface and to grind the cylindrical surface adjoining the shoulder during a single advance of the wheel towards the workpiece.

2. A machine according to claim 1 wherein the line of action achieved by the two X and Z movements of the wheelhead is 45° to the Z-axis.

3. A method of simultaneously cylindrical and face grinding a workpiece using a conventional cylindrical grinding wheel wherein a wheelhead on which the grinding wheel is mounted is moved simultaneously parallel to and perpendicular to the axis of rotation of the workpiece so as to define a line of action along which the wheelhead moves towards and into engagement with the workpiece to perform a single plunge grind operation along that line of action, the amount of material removed from the cylindrical and radial faces of the workpiece by engagement with the grinding wheel being just sufficient to form the

shoulder and adjoining cylindrical surface in said single operation.

4. A method according to claim 3 in which the cylindrical surface which is to be ground extends over an axially greater distance than that corresponding to the width of the wheel, the cylindrical surface is ground in a conventional manner (such as by means of a series of adjacent plunge grinds) leaving an annulus of unground material which extends axially over a distance which is less than the width of the wheel from an adjoining radial shoulder which is to be ground to size, whereafter the wheelhead is advanced along a selected line of action so as to remove the unground annulus and grind the adjoining radial face to size in a single plunge grind along the said selected line of action.

5. A computer controlled grinding machine when programmed to advance a wheelhead, which carries a conventional cylindrical grinding wheel mounted for rotation about an axis which remains parallel to the axis of rotation of a workpiece, along a selected line of action into engagement with the workpiece, wherein the line of action extends at an angle of less than 90° to the axis of rotation of the workpiece, so that unground material forming part of a cylindrical surface of the workpiece and an adjoining radial end face of the workpiece can be ground in a single plunge grind, in which the wheelhead moves along the said line of action into engagement with the workpiece and away therefrom after grinding.

6. A grinding machine in which a conventional cylindrical grinding wheel is carried on a wheelhead which is itself adapted for movement along a first X-axis, a workpiece is rotated about a second perpendicular axis (the Z-axis) and is mounted on a carriage which is movable parallel to the Z-axis, and wherein the wheel rotates about an axis which remains parallel to the workpiece axis of rotation, an X-axis drive is provided for advancing and retracting the wheelhead parallel

to the X-axis, a Z-axis drive is provided for moving the carriage parallel to the Z-axis, and signals are derived for controlling the X and Z-axis drives from a computer which is programmed to generate appropriate X and Z-axis drive control signals to produce simultaneous movement of the wheelhead and workpiece, such that the movement of the wheelhead relative to the workpiece is along a line of action which subtends an angle with the Z-axis which is less than 90° , whereby the external cylindrical surface of the grinding wheel serves to remove material from the cylindrical surface of the workpiece and an adjoining circular face of the wheel engages a radial shoulder of the workpiece to grind the latter to size as the wheelhead is advanced along the said line of action.

7. A method of simultaneously grinding cylindrical and radial faces of a workpiece using a conventional cylindrical grinding wheel in which the latter is advanced along a line which is perpendicular to the axis of rotation of the workpiece but which rotates about an axis which remains parallel to the workpiece axis of rotation throughout, and the workpiece is moved axially in a direction parallel to the axis about which the wheel is rotating, so that the movement of the grinding wheel relative to the workpiece is along a line of action which subtends an angle of less than 90° to the axis of rotation of the workpiece, so that the external cylindrical surface of the grinding wheel will remove material from the cylindrical surface of the workpiece to be ground, and an adjoining circular face of the wheel will engage and remove material from the radial face of the workpiece, and the angle made by the line of action relative to the axis of rotation is selected so that just the desired amount of material is removed from the said radial face, as the external cylindrical surface of the wheel removes material from the cylindrical face of the workpiece to bring it to size.

8. A computer controlled grinding machine in which a workpiece is movable by means of a carriage along an axis

parallel to the axis of rotation of the workpiece and perpendicular to the direction of advance and retraction of a wheelhead carrying a conventional cylindrical grinding wheel and in which the wheel is mounted for rotation about an axis which throughout remains parallel to the workpiece axis of rotation, when programmed to move the wheelhead and the workpiece carriage along the two orthogonal directions so as to produce a net movement of the wheelhead relative to the workpiece along a line of action which subtends an angle of less than 90° , relative to the axis of rotation of the workpiece, thereby to engage both a radial shoulder and a cylindrical surface of the workpiece to simultaneously grind both surfaces.

9. A grinding wheel for use in the apparatus according to any one of claims 1, 2, 5 or 6, or in the method of any one of claims 3, 4 or 7, wherein the external edge face of the grinding wheel is formed so as to provide two grinding faces of which one parallel to the axis about which the wheel rotates, but which comprise first and second frusto-conical surfaces, the first frusto-conical grinding face being perpendicular to the second frusto-conical grinding face, and the grinding wheel is mounted for rotation about an axis which makes the same angle with the axis of rotation of the workpiece as the first frusto-conical surface makes with the axis of rotation of the grinding wheel, so that the said first frusto-conical surface will cylindrically grind the cylindrical workpiece surface, and the wheel is mounted on a wheelhead which itself is movable at least perpendicularly to the axis of rotation of the workpiece and can either be moved parallel to the axis of rotation of the workpiece, with separate drives to produce the said two perpendicular movements, to advance the grinding wheel towards the workpiece along a line of action which is perpendicular to the axis of rotation of the wheel, or the workpiece is mounted on a carriage which itself is slidable parallel to the axis of rotation of the workpiece, and drive means is provided for moving the said carriage, and the

wheelhead and carriage drive means are operated so as to achieve the same relative movement between the wheel and the workpiece, along the said line of action, so that however it is moved, the wheel moves into engagement with the workpiece along the said line of action, and coolant is dispensed into the workpiece engaging region at least between the said second frusto-conical grinding surface and the radial shoulder of the workpiece being ground.

10. A method of simultaneously grinding cylindrical and radial surfaces of a workpiece in which a grinding wheel having two perpendicular frusto-conical grinding faces around its periphery is mounted for rotation about an axis which is coaxial with the coincident axes of the two cones of which the frusto-conical grinding surfaces form a part, the grinding wheel is mounted on a wheelhead so that one of the said orthogonal frusto-conical grinding surfaces will cylindrically grind a cylindrical surface of the workpiece, and relative movement is effected between the wheelhead and the workpiece so that the wheel engages the workpiece with the said one of the frusto-conical surfaces engaging to the cylindrical workpiece surface, and the other frusto-conical surface simultaneously engaging the radial surface which is to be ground, and a single plunge grind is performed along the line of action defined by the said relative movement such that just the required amount of material is removed from the two orthogonal surfaces of the workpiece as to leave both ground to size after the single plunge grind, and coolant fluid is directed into the region of engagement between at least one pair of grinding and workpiece surfaces.

11. A computer controlled grinding machine having a grinding wheel mounted on a wheelhead thereon for rotation about an axis which is coaxial with the coincident axes of two orthogonal frusto-conical grinding surfaces formed around the periphery of the grinding wheel, wherein the machine is programmed to produce relative movement between the wheelhead and the

workpiece along a line of action which is perpendicular to the axis of rotation of the wheel so that a single plunge grind will remove material from a radial and a cylindrical surface of the workpiece simultaneously.

12. A method according to claim 10 further comprising the step of dressing at least one if not both of the frusto-conical grinding surfaces, particularly that which engages a radial surface of a workpiece.

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INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference C522.01/W	FOR FURTHER ACTION see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.	
International application No. PCT/GB 00/ 00022	International filing date (day/month/year) 07/01/2000	(Earliest) Priority Date (day/month/year) 03/02/1999
Applicant UNOVA U.K. LIMITED et al		

This International Search Report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This International Search Report consists of a total of 03 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the report

a. With regard to the **language**, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international search was carried out on the basis of the sequence listing :

☐ contained in the international application in written form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished

2. ☐ **Certain claims were found unsearchable** (See Box I).

3. ☐ **Unity of invention is lacking** (see Box II).

4. With regard to the **title**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established by this Authority to read as follows:

5. With regard to the **abstract**,

☒ the text is approved as submitted by the applicant.

☐ the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the **drawings** to be published with the abstract is Figure No.

☐ as suggested by the applicant.

☒ because the applicant failed to suggest a figure.

☐ because this figure better characterizes the invention.

1

☐ None of the figures.

INTERNATIONAL SEARCH REPORT

International Application No.

PCT/GB 00/00022

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B24B5/01

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B24B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	"7-ACHSEN-SCHLEIFZENTRUM FUER SIMULTANES INNEN- UND AUSSENSCHLEIFEN" VDI Z, DE, VDI VERLAG GMBH. DUSSELDORF, vol. 132, no. 7, 1 July 1990 (1990-07-01), page 92 XP000136011 ISSN: 0042-1766	1, 3
Y	the whole document	2, 4, 5
X	DE 15 77 485 A (SCHAUDT MASCHINENBAU GMBH) 16 September 1971 (1971-09-16)	6-8
Y	page 7, last paragraph -page 8, paragraphs 1, 2; figure 1	2, 4, 5
Y	US 4 709 509 A (YONEDA TAKAO ET AL) 1 December 1987 (1987-12-01) column 3, line 63 -column 4, line 36; figure 1	9-12
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☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

* Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

14 April 2000

Date of mailing of the international search report

25/04/2000

Name and mailing address of the ISA

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Authorized officer

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 00/00022

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	EP 0 169 971 A (BARBISAN LUCIANO) 5 February 1986 (1986-02-05) page 7, last paragraph ---	9-12
A	EP 0 257 194 A (BUDERUS KUNDENGUSS) 2 March 1988 (1988-03-02) column 1, line 26 - line 38; figure 1 -----	9-12

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 00/00022

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
DE 1577485	A	16-09-1971	NONE		

US 4709509	A	01-12-1987	JP	1812829 C	27-12-1993
			JP	5023909 B	06-04-1993
			JP	62094260 A	30-04-1987

EP 0169971	A	05-02-1986	IT	1176410 B	18-08-1987

EP 0257194	A	02-03-1988	DE	3628977 A	03-03-1988
			JP	63062649 A	18-03-1988
